



Patent
Docket No. 42598-1400

THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Akio Ishii et al.

Application No.: 09/980,366

Filed: November, 2001

For: CARBONACEOUS REFRACTORY
AND METHOD FOR PREPARING
THE SAME

Patent Examiner: Paul D. Marcantoni

Group Art Unit: 1755

May 30, 2003

Irvine, CA 92614

CLEAN VERSION OF PENDING CLAIMS

Dear Sir:

In response to the Office Action, mailed February 19, 2003, see the following clean version of the amended claims as a courtesy to the Examiner:

CLEAN VERSION OF PENDING CLAIMS

1 Claim 1 (Currently Amended): A carbonaceous refractory material containing 50 to 85%
2 by mass of carbon, 5 to 15% by mass of refractory metal oxide, 5 to 15% by mass of metallic
3 silicon, and 5 to 20% by mass in total of at least one selected from the group consisting of
4 metallic titanium, titanium carbide, titanium nitride and titanium carbonitride TiC_xN_y , where $0 < x, y < 1$ and $x + y = 1$,

6 where the X-ray diffraction peak intensity ratio of the face (200) of the Ti_3O_5 to
7 the face (111) of titanium carbide is 1% or less.

1 Claim 2 (Currently Amended): A method for producing a carbonaceous refractory
2 material by compounding 50 to 85% by mass of carbonaceous materials, as main raw materials,
3 which are calcined anthracite, calcined coke, natural graphite, artificial graphite or these mixture,
4 with 5 to 15% by mass of refractory metal oxide ~~powder~~, 5 to 15% by mass of metallic silicon
5 ~~powder~~ and 5 to 20% by mass in total of at least one selected from the group consisting of
6 metallic titanium, titanium carbide, titanium nitride, and titanium carbonitride TiC_xN_y , where $0 < x, y < 1$ and $x + y = 1$, and by adding organic binder to the mixture, then kneading, forming and
7 baking in non-oxidation atmosphere to obtain the carbonaceous refractory materials in the first
8 claim,

10 where the X-ray diffraction peak intensity ratio of the face (200) of the Ti_3O_5 to
11 the face (111) of titanium carbide is 1% or less.

1 Claim 3 (Cancelled)

1 Claim 4 (Currently Amended): The carbonaceous refractory material of claim 1, where
2 the refractory metal oxide contains at least one selected from the group consisting of alumina,
3 zircon, magnesia, mullite, spinel and silica.

1 Claim 5 (Currently Amended): The method of producing the carbonaceous refractory
2 material of claim 2, where the refractory metal oxide powder contains at least one selected from
3 the group consisting of alumina, zircon, magnesia, mullite, spinel and silica.

1 Claim 6 (Cancelled)

1 Claim 7 (New): The carbonaceous refractory material of claim 1,
2 wherein the 5 to 20% by mass in total of at least one selected from the group
3 consisting of metallic titanium, titanium carbide, titanium nitride and titanium carbonitride
4 TiC_xN_y , where $0 < x, y < 1$ and $x + y = 1$, enables the formation of a high melting protective layer
5 bound to the carbonaceous refractory material.

1 Claim 8 (New): The method of producing the carbonaceous refractory material of claim
2 2,

3 wherein the 5 to 20% by mass in total of at least one selected from the group
4 consisting of metallic titanium, titanium carbide, titanium nitride and titanium carbonitride
5 TiC_xN_y , where $0 < x, y < 1$ and $x + y = 1$, enables the formation of a high melting protective layer
6 is formed in the proximity of the refractory material surface.

1 Claim 9 (New): An improved durable carbonaceous refractory material for lining the
2 side walls and bottom region of a blast furnace hearth, the improved durable carbonaceous
3 refractory material having a reduced carburization dissolution rate and an increased wettability

4 with molten iron to yield excellent corrosion resistance properties, the improvement consisting
5 essentially of:

6 50 to 85% by mass of carbon;

7 5 to 15% by mass of a refractory metal oxide, the refractory metal oxide contains
8 at least one selected from the group consisting of alumina, zircon, magnesia, mullite, spinel and
9 silica, the refractory metal oxide being present in a sufficient amount to form a residual
10 refractory metal oxide layer in proximity to the surface of the carbonaceous refractory materials
11 even after dissolution of the carbon aggregates and to stay between the carbonaceous refractory
12 material and molten iron to prevent the contact between the carbonaceous refractory material and
13 the molten iron, thereby reducing the consumption of the carbonaceous refractory materials;

14 5 to 15% by mass of metallic silicon; and

15 5 to 20% by mass in total of at least one metallic titanium or titanium compound
16 selected from the group consisting of metallic titanium Ti, titanium carbide TiC, titanium nitride
17 TiN, titanium carbonitride $TiC_{0.7}N_{0.3}$, and titanium carbonitride $TiC_{0.3}N_{0.7}$, the metallic titanium
18 or titanium compound being present in an amount to sufficiently cover the whole surface of the
19 carbonaceous refractory material which is not sufficiently supplied by the residual refractory
20 metal oxide layer after the dissolution of the carbon aggregate, such that a durable and
21 economical covering layer is formed, the metallic titanium or titanium compound allowing
22 improved wettability with molten iron,

23 wherein the X-ray diffraction peak intensity ratio of the face (200) of the Ti_3O_5 to
24 the face (111) of titanium carbide is 1% or less.

1 Claim 10 (New): The improved durable carbonaceous refractory material of Claim 9,
2 wherein the particle size of the refractory metal oxide being sized in the range of
3 approximately 2 μm to 3 μm .

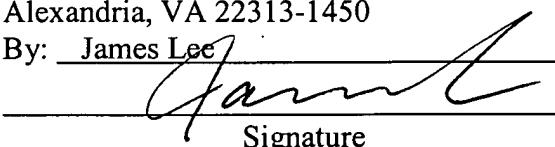
1 Claim 11 (New): The improved durable carbonaceous refractory material of Claim 9,
2 wherein the particle size of the metallic silicon being sized in the range of
3 approximately 1 μm to 74 μm .

1 Claim 12 (New): The improved durable carbonaceous refractory material of Claim 9,
2 wherein the particle size of the metallic titanium and titanium compounds being
3 sized approximately 7 μm .

If the Examiner believes a telephone interview will be helpful to advance the prosecution
of this case, he is respectfully invited to contact the undersigned attorney at the listed telephone
number.

Respectfully submitted,

I hereby certify that this document and fee is
being deposited on May 30, 2003 with the U.S.
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